The plates are developed in hydroquinone, and when fixed, dried, and labeled are ready for measurement. As the method of measuring x's and y's of the sun spots and reducing the same to the heliographic position by the usual trigonometrical computation is long and tedious and of greater accuracy than the nature of the problem seems to require or allow, a modification of the projective method devised by Hale and used at Yerkes and Mount Wilson has been adopted which has perhaps some merits as regards simplicity and convenience of operation.

In place of the steel ball used by Hale, we make use of a well-made white globe with celluloid finish, upon which marks can be made and erased with perfect satisfaction. The globe is 8 inches in diameter and is mounted in a supporting ring graduated into degrees. This supporting ring in turn is mounted in a fork support which may be adjusted about a vertical axis by the amount necessary to allow for the tip of the solar pole to or from the earth. The angle of inclination of the sun's axis to the fundamental plane perpendicular to the line of sight is taken from the Ephemeris, as is also the position angle of the solar axis with respect to the north and south line.

The adjustment of the axis of the globe for the latter inclination or position angle with the north and south line is effected by turning the supporting ring in the fork which supports it. The graduations on a horizontal circle facilitate the adjustment of tilt with respect to the fundamental plane, whereas the graduations of the supporting ring of the globe itself allow for accurate orientation of the axis in position angle.

When the globe has once had its axis adjusted to correspond to that of the sun for the day in question, the photographic negative is placed in the projecting lantern and the image of the negative solar disk cast upon the globe. The size of the image is made to exactly fit the globe by adjusting the distance of the globe from the lantern in conjunction with the focusing of the projecting lantern itself in the usual way. In this way compensation is provided for the change in the apparent diameter of the sun throughout the year.

With the solar image projected onto the globe the centers of all visible spots can be accurately located with a sharp-pointed pencil and numbered in any sequence or date desired. It is usually possible to mark on the globe the positions of spots from several negatives taken on successive days without confusion.

As soon as all the spots have been thus located for a given day or series of days, a solar meridian is carefully drawn along the edge of the brass supporting ring which will make possible the resetting of the globe to the same identical position or for any other longitude of sun's center that may be desired. The globe thus marked together with its supporting ring is then removed from the supporting stand and placed in a precision mounting accurately machined and with a horizontal circle reading by degrees from 0° to 360°. The globe and ring is placed in the stand so that the axis of the globe is perpendicular to the horizontal circle. The position of the pole is read directly from the brass supporting ring.

The globe is then rotated in its stand until each spot in turn is brought under the meridian ring from which the heliographic latitude is at once read directly to the nearest degree and by estimation to the nearest tenth of a degree. The difference in heliographic longitude is obtained at the same time by noting the movement of the fiduciary meridian with respect to the horizontal circle, reading again directly to the nearest degree and by estimation to the nearest tenth of a degree. The values published are referred to the meridian passing through the center of the sun's disk and are expressed to the nearest degree. By such an arrangement it is possible to make several independent set-ups and thus automatically check the determination of the position and reduce the probable errors of reading as desired.

It is sufficient to add that we have found such a method and arrangement greatly superior to the use of any of the several sets of sheets giving heliographic coordinate systems for certain limiting dates both as regards accuracy and facility in obtaining the desired data.

For determining the areas of spots, concerning which it is understood that areas in terms of the sun's hemisphere are desired, a plane metal disk is used in place of the globe as a projecting screen. This disk is covered with a sheet of coordinate paper, which has ruled upon it a circle 8 inches in diameter. The solar image is made to fill the 8-inch circle and the area of a spot is estimated in terms of the number of millimeter squares which are covered by the umbra and penumbra of the spot. These areas are then corrected for foreshortening by multiplying by the secant of the angular distance of the spot from the center of the disk, the corrected areas being then divided by the area of the hemisphere in square millimeters $\times 10^{-6}$ to give the actual area in millionths of the sun's hemisphere.

Experiments are in progress for the measurement of sun-spot areas by the use of a modification of the thermoelectric photometer,[1] but ways of eliminating or correcting for the varying background absorption have not yet been completely and satisfactorily worked out.—*H. T. Stetson.*

YERKES OBSERVATORY

At the Yerkes Observatory the direct photographs of the sun are taken with the 12-inch Kenwood equatorial diaphragmed down to an aperture of 3 inches. The focal length of the telescope is 5.49 meters, so that the solar image is about 51 millimeters in diameter. Sharp images are obtained with the lens, which is corrected for visual rays, by using a yellow filter and Eastman process plates. Short exposures are given by means of a plate shutter, operated by a spring, and reduced to a slit about 3 millimeters wide, over which the glass filter is fastened. The image was formerly oriented by means of the shadow of a metal wire stretched across the image of the sun; before the exposure the wire was oriented by projecting on it the image of the sun and examining on a ground glass to see if the wire was parallel to the diurnal motion of the sun's limb. Difficulty was encountered in keeping the metal wire perfectly straight. Since March 1, 1927, the orientation of the camera is obtained by using the edge of the shutter instead of a metal wire. This edge has been made exactly perpendicular to the direction of motion of the slit. A small opaque spot on the filter appears as a fine straight line on the negative, thus indicating the north-south direction.

For measuring the negatives they are projected by an arc lamp on the 6-inch graduated disks prepared by the Stonyhurst Observatory for that purpose. (Journal of the British Astronomical Association, vol. 18, p. 26, 1907.) The constants for the date determine the disk to be used and the rotation to be given to the negative so that one can read directly the latitudes, the differences of longitude between the spot and the central meridian, and also the areas in square degrees.—*George Van Biesbroeck.*

[1] Astrophysical Journal 43:253:58:36.